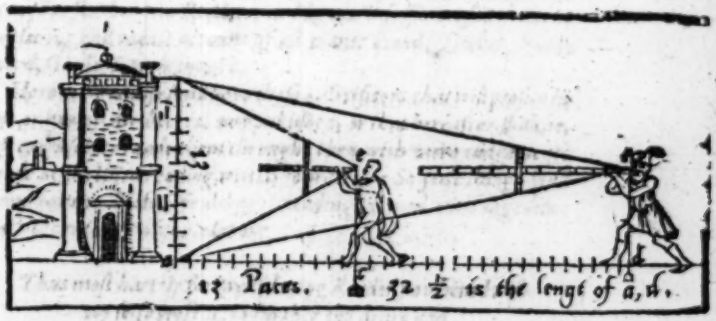
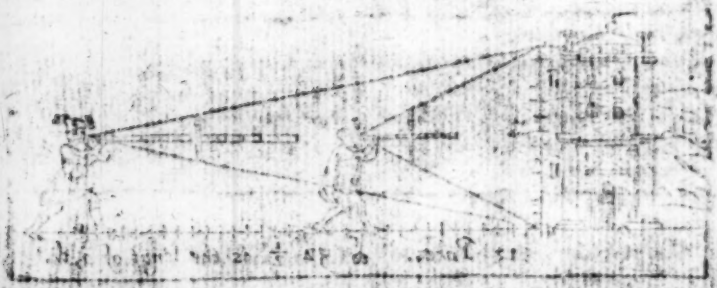
A BOOKE NAMED
Tectonicon,

Briefly ſhewing the exact meaſuring, and *ſpeedie reckening all maner of Land, Squares*, Timber, Stone, Steeples, Pillers, Globes, &c. Further, declaring the perfect making and large vſe of the Carpenters Ruler, *conteining a Quadrant Geometricall: comprehending alſo the rare* vſe of the Squire. And in the end a little Treatiſe adioyning, opening the compoſition and appliancie of an Inſtrument, called the profitable Staffe. With other things pleaſant and neceſſarie, moſt conducible for Surueyers, Landmeaters, Ioyners, Carpenters, and Maſons.

Publiſhed by LEONARD DIGGES *Gentleman, in the yeare of our Lord*, 1556.



Imprinted at London by Felix Kingſton, dwelling in Pater noſter Rowe, ouer againſt the ſigne of the *Checker*. 1599.



L.D. To the Reader.

ALthough (gentle Reader) many, excellent in Geometrie, vpon infallible grounds haue put foorth diuers moſt certaine and ſufficient Rules, touching the meaſuring of all manner Superficies: yet in that the Arte of vnmbring hath been required, yea chiefly thoſe Rules hid, and as it were locked vp in ſtraunge Tongues, they doe profite (or haue furthered) very little the moſt part: Certes nothing at all, the Landmeater, Carpenter, maſon, wanting the aforeſayd. For their ſakes, I am here prouoked not to hide, but to open, and ſo encreaſe the Talent which I haue receiued: yea to publiſh in this our tongue very ſhortly (if God giue life) a volume containing the flowers of the Sciences Mathematicall, largely applied to our outward practiſe, profitably pleaſaunt to all maner men in this Realme. In the meane time I ſhall deſire the Artificers aboue named to be contented with this little Booke (a taſt of my good will towards them) which I wiſh euen ſo to further the Readers, as I knowe it ſufficient for the true meaſuring and readie account of all maner Land, Timber, Stone, Boord, Glaſſe, Pauement, &c.

Here mine aduiſe ſhall be to theſe Artificers that will profite in this, or any of my bookes, now publiſhed, or that hereafter ſhall be, firſt confuſely to reade them through, then with more iudgement. Reade at the third reading wittely to practiſe: So fewe things ſhall be vnknowne. Note, oft diligent reading, ioyned with ingenious practiſe cauſeth profitable labour.

Thus moſt hartely farewell (louing Reader) to whom I wiſh my ſelfe preſent, to further thy deſire and Practiſe in theſe.

The pleaſant profit or content of this little Booke, and in what it exceedeth *all other publiſhed.*

OThers bookes tofore put forth in our Engliſh tongue, contayned onely the bare meaſuring of Land, Timber, and Boord: how agreeable in all places to the rules of Geometrie, let the learned iudge. Here (gentle Reader) thou ſhalt plainely perceiue through diligent reading, how to meaſure truly, and very ſpeedily all maner Land, Timber, Stone, Steeples, Pillers, Globes, Boord, Glaſſe, Pauement, &c. Without any trouble: not painted with many rules, or obſcure termes, nor yet with the multitude of Tables, as heretofore hath been: in which not a few errors were committed: for that cauſe no iuſt account might any way be had. Further, ye ſhall by this booke vnderſtand the whole making and comely handling of the Carpenters Ruler, with the true meaſure, &c. And his vſe appointed to the ready meaſuring of all kind of Timber, Stone, Boord, &c. Alſo the leuelling of grounds, and taking of heights, is pleaſantly and diuerſly practiſed by the Ruler. Ye haue here not the common, but the rare vſe of the Squire, applied to heights, lengths, &c. And to the finding of the iuſt houre of the day diuerſe waies, through the ayde of pleaſant Tables newly adioyned to my generall Prognoſtication: by the which the proportion of things, direct or ſquirewiſe ſtanding, are by their ſhadowes knowne.

To conclude, in the end of this Booke is added a Treatiſe, ſhewing the making, and vſe of an Inſtrument, by which yee ſhall get lengths, heights, breadths, wideneſſes, where or howſoeuer they ſtand. Other neceſſarie things are contained in this little volume, which I commit to the diligent Reader.

DIVERS THINGS
conducible, to the Arte of Measuring.

The first Chapter.

AS there are fewe Craftsmen which haue all the kindes of Arithmetike readily: so I dow suppose none so ignorant, but that they dow, or may easilie perceiue the simple significations of these Characters or figures, 1.2.3.4.5.6.7.8.9.10. And also their strength in the first, second, and third rowmes placed. Character numerall.

Besides that, they must bee familiar with these and such like fractions.

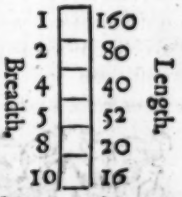
$\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{7}$ $\frac{1}{12}$ $\frac{1}{11}$ $\frac{3}{4}$ $\frac{4}{7}$ $\frac{9}{10}$. The first leftward betokeneth one second part of an whole, be it Pearch, Inch, or any other measure: the next, one third, then one seuenth part: the other ensuing, one sirtenth. So one thirtie and two parts of an Inch. Then follow three fourths: foure fifthes. The last is nine tenthes of an Inch: that is nine parts of an Inch, deuided into ten portions. Fractions.

These I dow intende to put in my examples, and in my Tables and margines following, to represent parts of Pearches or Inches. As if I would write halfe an Inch, after

this maner ¼. Thrée quarters of an Inch thus ¾. One eight of a Pearch, on this wise ⅛. So of the reſt.

It is requiſite alſo here to open what a Pearch, a Day worke, a Rode, and an Acre is.

Although there are diuers opinions engendred through long cuſtome in many places, of the length of a Pearch (vpon which our chiefe matter dependeth) yet there is but one true Pearch by Statute appoynted to meaſure by. Wherein is ordeined thrée Barly cornes drie and round to make an Inch: twelue Inches, a Foote: thrée Foote, a Yarde: fiue Yardes, and ½. a Pearch: fortie Pearches in length, and foure in breadth an Acre. So an Acre by ſtatute ought to containe 160. Pearches; the halfe Acre 80. Pearches; a Rode commonly called a quarter 40. Pearches, a day worke 4. Pearches. Lo here the Acre expreſſed with his length, and breadth.



Inſtruments to meaſure with Poales Cord knotted. Profitable ſtaffe.

I muſt not omit héere to tell you what thing is méete to meaſure land with. They vſe commonly in the countrey two Poales, either of them the length of a Pearch. They are very good. Yet for all kinde of Land, a Corde fiue Pearches in length, well ſeared with ware and roſen, knotted or marked at the end of euery Pearch, is more méete and readier. But in my fantaſie, the Inſtrument Geometrical, which is put forth in the end of this booke, paſſeth them all and other, for the exact truth and quickeſt ſpéede. This Inſtrument is ſo generall and auailable to ſo ſundry things, that it alone requireth a large booke, if it ſhould be ſufficiently ſet forth.

Triangle.

Alſo I would not haue you ignorant what péece of Land is called a Triangle, which often ſhall hereafter be named. It is ſuch a faſhioned péece as hath (or is imagined to haue) thrée ſides, and thrée Angles onely: whether the ſides bée equall or otherwiſe, as this figure ſheweth. Againe, note that a line is ſaid to fall Squirewiſe, when it cutteth any thing, or any ſide of a Triangle full croſſe, like vnto a Squire: As the

hanging

hanging pricked line a. b. in c. d. the base line of the Triangle. It cutteth the side iquitewise, or full crosse in the poynt b. and not as the other line a. c. doth. The base of any Triangle is here called that side, which is cut iquitewise with the hanging line.

Concerning a Circle, know we that the compasse of any Circle is named a Circumference: the middle poynt in him his Center: the right line h. i. that goeth ouerthwart that Center touching the Circumference on both sides is his Diameter: the halfe of that line, the Semidiameter. Also an Arch is a peece of the Circumference cut away, as ye see the Arch above the line f. g. Also f. g. h. i. in this Circle are named Parallels: for that they differ equally in all places, the one from the other.

Note, because practise and experience sheweth me, that there is almost no Land, but it may easily be brought by imagination to a Triangle or Triangles, and so most truely measured: therefore, to be short, this order shall be taken. I will first figure and set afore your eyes Triangled Land, and other which by imagination shall be brought into Triangles. Then I shall teach the true measuring of them: I meane, how to finde a length and breadth, with which ye shall enter the table of account following, where the Acres and odde Pearches (if there be any) shall appeare.) As these figures are measured, so all Triangled Land, and other brought into Triangles, of what fashion so euer they be, shall be measured. And because it is requisite for true measuring of all Triangles, to finde a streight hanging line, I shall shew first how that line is to be found, imagined, or drawne.

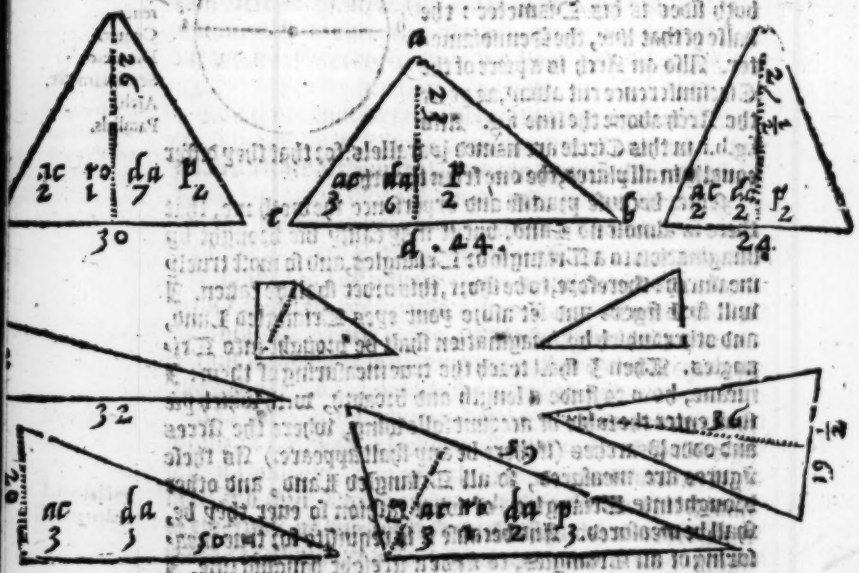
How

How the right hanging line in Triangles is drawne.

The j. Chapter.

To draw a hanging or plumbe line.

THis straight hanging line in all Triangles is euer drawne or imagined from any Angle, cutting some one sides of that Triangle squre wise: as ye may perceiue the pricked lines in the Triangles following. By the helpe of this line, all Lands of Triangle fashion, are wrought to bee measured as ensueth.



How to measure all maner Triangled Land.

The iij. Chapter.

IF thou bée an Arithmetician, multiplie this streight hanging line, drawne, as aboue is shewed, in halfe the number of Pearches of that side, which it cutteth squirewise. For want of the knowledge, take the aforenamed Pearches (I meane of the hanging line, and halfe the side which he cutteth) and with that length and breadth enter your table of account, as there is set forth. So shall ye perceiue the number of Acres, Rods, Dayworks, &c. Euclid the 1. Booke, 41. pro.

Example.

FOr the perfect measuring of Triangles aforefigured, and all other, suppose the second of these last nine figures of the other side, hauing written aboue it a.b.c.d. to bée a peece of land, whereof I would haue the true measure, I finde by a Corde, otherwise, the pricked hanging line a. d. to be 23. Pearches: the side b.c. which it cutteth squirewise 44. Pearches, whose halfe is 22. With these 22. and 23. the conuenient length and breadth, I enter the table of account. There I finde by that Table at the corner where both the lines of conuenient length and breadth dw méete 3. Acres, 6. dayworkes, and two pearches to be in that Triangle. Thus of all before figured.

Here note your Table must euer bée entred with all the Pearches of the hanging line, and with halfe the side that he cutteth squirewise. Or with the halfe hanging line, and the whole side cut. This Table followeth.

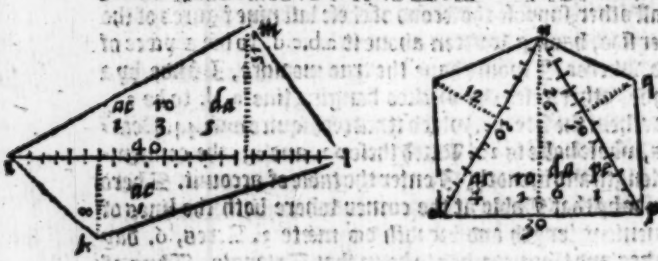
A figure of a double Triangle.

This figure e.f.g.h. is but two Triangles: and therefore measured as aboue in two parts: Do thus. The hanging line, e.g. is 33. Pearches: the side f.h. that he cutteth squarewise 20. Pearches, the halfe of the which is 10. Now enter your Table as afore, with 33. and 10. the conuenient length and breadth. So shall ye finde two Acres, two Dayworks, and two Pearches, the true content of this figure e.f.g.h.

Another example.

Figures of many Angles.

A Land i.k.l.m. land to be measured. Because it is no manner Triangle, it must be brought by imagination, as I haue sayd, into a Triangle or Triangles. Which imagination is here signified by the line dashed i.l. Then as aboue is



declared, it ought to be measured (according to the rule of Triangles) in two parts, because there are two Triangles in that land. So by your se ye shall finde in the vpper i.m.l. one Acre, 3. Rodes, and fiue Dayworks: in the other i.k.l. one Acre. Thus I gather the whole content of that Land, to be two Acres, three Rodes, and fiue Dayworks.

Now

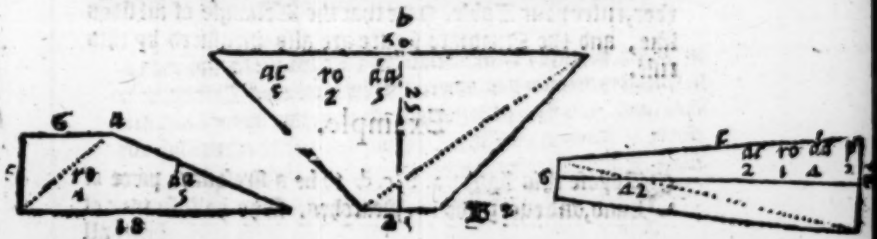
None otherwise of the adioyned n o.p.q. and all other fi-gures following: and other whatsoeuer they are, that by any meanes may be brought into Triangles.

Furthermore know that the figure i.k.l.m. is readily thus measured. Adde the Pearches of both the hanging Lines together: so haue ye 23. With this number, and with halfe the Pearches of the side, i.l. which he cutteth squire wise, being 10. Pearches, enter your Table. So is found as afore.

These two figures following may also be thus measured, otherwise then by the rule of Triangles. Enter your Table with their conuenient length and breadth. So shall ye finde the contents of all such.

These three figures following, although they may be measured by the rule of Triangles, yet for quicker speed, they haue also their proper measuring as ensueth.

Lay together the two sides which are parallels of the first figure a. that is 6. & 18. making 24. the halfe is 12. the breadth, 5. Enter with 5. and 12. your table. So haue you one rod, and fiue day works. For the other two b.c. and such like, ioyne the heads or ends in one: and enter your table with halfe of those Pearches, and with the whole number of the middle line.



How by ſupputation to meaſure all triangled land.

To meaſure triangled land by ſupputation.

IOyne all the ſides together: take halfe out of that halfe, pull euery ſide, noting the difference. Then multiply the differences, the one in the other, and the third difference augment in the product. That which encreaſeth, multiplie in the halfe of all the ſides ſoyned. Then the Radix of the ſurmounting ſumme is the content of that Triangle.

Foure rules following.

Now reſt foure Rules to be treated of. The firſt for all maner Regular ſquare Superficies. The ſecond for round Land, and her parts. The third for Steeples, Columnes, Globes, and their parts. The laſt for Mountaines, and Valleyes. Heere they ſhall in order follow.

A rule for all maner Regular or right ſquared Land of many ſides, as 5.6.7.8.9.10.20.100.&c.

The iiij. Chapter.

To meaſure land of many ſides.

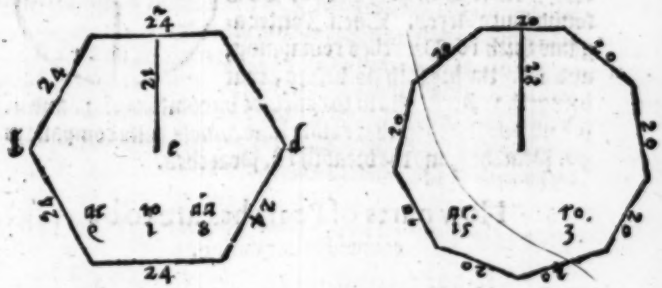
MEaſure and lay all the ſides together, taking the halfe number of Pearches there contayned. Then draw a right hanging line from the Center or middeſt of that figure, or the middeſt of ſome one ſide. And with that length and the other, enter your Table. Note that the Triangle of all ſides like, and the Quadrate figure are alſo meaſured by this rule.

Example.

SVppoſe this figure a. b. c. d. to be a ſiresquare peece of Land, and euery ſide 24. Pearches. The halfe ſumme of all

all sides is 72. Pearches: the right hanging pricked line a.c. 21. Pearches. With these two numbers ye must enter your Table of account following hereafter. And doe as is opened in the declaration there adioyned, when Numbers surmount the Table as they doe here.

So shall ye find 9. Acres, 1. Rood, and 8. Daywerkes, the content of this figure a.b.c.d. Euen thus is the other nine squared figures measured, and such like.



A Rule for round Land, and the parts thereof.

The v. Chapter.

HAlfe the Diameter multiplied in halfe the Circumference, sheweth the content of any Circle. Archimedes in libello circuli mensuracionis.

Or thus more plainely. Ye shall enter your Table with halfe the number of Pearches of the whole Circumference or compasse, and with the number of halfe the Diameter or breadth. So haue ye the content.

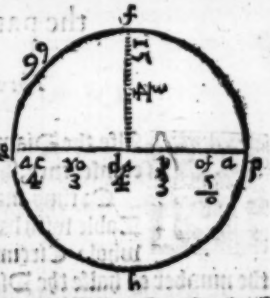
Example.

Suppose a peece of land, whereof the compasse is 100. pearches, the breadth 32. Pearches, I would know how much Land is in this figure. Enter your Table with halfe the compasse, that is 50. and with halfe the breadth, that is 16. Pearches. Because in the Table I cannot finde 50. for the greatest length is 40. (therefore I enter with 40.) and 16. So is found foure Acres. Then I enter againe with 16. Pearches remayning, and 16. the breadth as before, that bringeth 1. Acre. Now to conclude by addition of 1. and 4. I find fiue Acres in that round land, whose halfe compasse is 50. Pearches, and the breadth 16. Pearches.

How parts of Pearches are to be counted in measuring.

For perfect knowledge and vse of this Table following, when parts of Pearches are adioyned, note well this other example that ensueth, and also what is said of the declaration annexed vnto the table, when parts of Pearches are in the length, breadth, or both.

Imagine f.g.h. to be a round peece of Land: I finde by measure the whole compasse, 99. Pearches. The halfe is 49. $\frac{1}{2}$. The hanging Line or halfe breadth is 15. $\frac{1}{4}$. Enter your table with the whole Pearches, that is 49. and 15. leauing out $\frac{1}{2}$. and $\frac{1}{4}$. which were but parts of Pearches, So haue ye

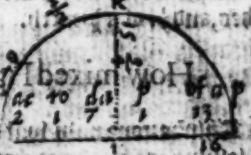


ye 4. Acres, 2. Rods, 3. Dayworks, and 3. Pearches. For those parts of Pearches omitted, at your first entring the Table, worke thus. The halfe Pearch. Quarter, or other part of a Pearch in the length, must be reckened by themselues in the whole breadth, and those of the breadth contrariwise in the length. If there be such odde parts in both, then recken them of the length in the whole breadth, and them of the breadth in the whole length, joyning to the other afore gotten, remembring the product of the one fraction multiplyed in the other, to be pulled from the encrease. To make this matter plaine, I will take this last example before. The one number where with I should haue entred my table, was 49. ½. the other 15. ½. I found first by entring with 49. and 15. (omitting the odde parts) 4. Acres, 2. Rods, 3. Dayworks, and 3. Pearches. Now for the encrease of the Parts of Pearches left out, I must (as I said) recken them of the length in the breadth, and contrariwise them of the breadth in the length. Halfe 15. ½ is 7. Pearches, and ½. Three quarters of 49. is 37. Pearches, ½. Which added, makes 45. Pearches. This adioyned to the number afore gotten, wingeth the whole content of the round figure, which is 4. Acres, 2. Rods, 3. Dayworks, 3. Pearches, and ½. of a Pearch, the product of the one fractiō multiplied in the other subducted. What must be done when the numbers where with ye should enter, exceede your table, counsel the declaration of your table there adioyned.

Of the halfe Circle.

To measure halfe circled Land.

For this halfe circle, enter the Table with halfe the compasse, and with halfe the Diameter of the Circle, or with the length of the pricked hanging line, k.l. So the content of this halfe Circle is 2. Acres, 1. Rood, 7. Dayworkes, 1. Pearch, and ½. of a Pearch.



Another

Another example of Portions and parts of a Circle.

SVppose n.m.o. following, were a part of a Circle or peece of Land, whose Content ye desired. The whole Compasse of the Circle which this portion representeth, is (as afore-sayd) 99. Pearches: his Diameter or breadth 31. ½. The pricked Arke or Compasse, n.m.o. is 74. Now with the halfe Breadth or Semidiameter of the Circle, 15. ¾. and with 37. the halfe of the pricked Compasse: enter your Table. So haue ye 3. Acres, 2. Rodes, 5. Dayworkes, 2. Pearches, and ¾. of a Pearch, the Content of the peece of Land full of pricks, to the sides of the Triangle pricked.

To measure parts of circled Land.

If ye desire to know the sum of Pearches in the other portion beneath the Triangle, separated by the line m.o. ye must adde the Content of the Triangle (which is 3. Rodes and ¼. of a Pearch, found by the Rule of Triangles) to the Acres and Pearches before searched. So haue ye 4. Acres, 1. Rode, 5. Dayworkes. 3. Pearches, and ¼. of a Pearch.

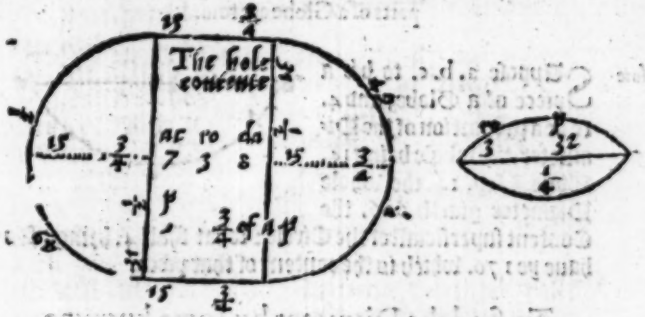
This subtracted or pulled from the number contayned in the whole Circle, the remaine is the Pearches included in the small peece beneath the Triangle. That is, 1. Rod, 36. pearches, and ¼. of a Pearch.

How mixed Figures are measured.

Land compounded of circles, or his parts.

I Thinke none now will doubt how these two figures following are measured, because they are made of portions or parts of Circles, whose measure is before sufficiently opened.

ned, the one consisting of two halfe Circles, & a Quadrangle: the other being the portions of the Circle, mo. doubled.



If any euill fashioned Land chaunce to be measured, which requireth to bee brought into many Triangles, to saue labour, ye may adde some portion vnto that, and make it square, or otherwise. So let it then be measured: and after, from the product pull away that yee added: the remaine is the Content.

To finde the content superficiall of Steeples, Columnes, Globes, and their parts.

To measure Steeples, Columnes, Globes, &c.

TO the Arithmetician I say: for picked Steeples, multiplie the whole side in halfe the Circumference of the Base, adding the plaine of that Base. For pillers, augment the Circumference of the Base in the Heights, putting to the plaine of both Bases. For Globes, the Diameter in the Circumference multiplied: euen so of Fragments or parts. Let them that be voide of Arithmetike enter my Table of account following, with such numbers as I now willed the Arithmetician to multiplie, not forgetting what I haue before written. So I serue their turne.

Or thus by the rule of proportion, the parts of a Globe are found.

To measure parts of Globes.

Suppose a. b. c. to bée a péece of a Globe, and 4. to be a proportion of the Diameter, the whole being 14. Thus I say, 14. the whole Diameter giueth 616. the Content superficiall of the Circle: what shall 4. bring? So haue ye 176. which is the content of that péece.

To find the Diameter by some knowne portion thereof.

To find the vnknowne Diameter of a Globe.

If ye be ignorant what length the Diameter of the Globe is, whose portion ye haue, the height or part of the Demecient being 4. Forte, augment halfe the Line a.b. which is 6. ½. in himselfe, and the product diuide by 4. So haue ye 10. to be added to 4. which maketh 14. the whole Diameter.

The true measuring of Mountaines and Valleys.

The vj. Chapter.

To measure Mountaines.

First ye shall measure the circuit of the Forte, or Base of the Mountaine: then the compasse of the Summitie or top, adding them together. So shall ye doe of the Ascenses, that is, the going vp from the forte to the top, ioyning the measure of the longer and shorter in one. Now take the halfe of the circuit added, and the halfe part of the Ascenses ioyned, and enter your Table: there shall ye see the Content.

Ensample.

Enſample.

A.b.c. is the Mountaine: a.c. the circuit of the Baſe, being 100. Pearches, b. the top 16. Pearches. Which ioyned together make 116. b. c. the one Aſcenſe is 55. Pearches: the other 75. Theſe added make 130. The halfe of the circuits is 58. the halfe of the Aſcenſes 65. with theſe two ſummes yée ſhall enter your Table of account, where yée ſhall find 23. Acres, 2. Rodes, and 10. Pearches, the true content of this figured hill.

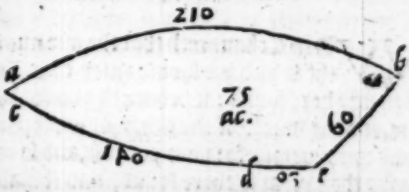
Figure of a Mountaine.

Of the Valley.

AS in the Mountaine ye meaſured the circuit or compaſſe of the Baſe or Foote: ſo here contrarie yée ſhall méete round about the circuit or compaſſe of the height of the Valley. And as yée got the meaſure or compaſſe of the top of the Mountaine: ſo meaſure the circuit of the Depth of the Valley. In like maner as yée meaſured the Aſcenſe, that is, the going vp from the foote to the top: ſo meaſure the Diſcenſe or going downe of the Hill, to the depth of the Valley. The reſt all worke, as I haue ſhewed you in meaſuring the Mountaine. For more plainnes, behold this enſample or figure. If ye lay together the circuites of the height & depth, which is 210. and 30. taking the halfe part of thoſe two Circuites, making

To meaſure Valleys.

Figure of a Valley.



an 120: then the two Ascenses 140. and 60. added in one product 200. the halfe thereof being 100: with this and 120. the other halfe of the Circuite, ye may enter your Table. That doing, loe 75. Acres.

How the Table of account now following, is to be vsed.

When you haue gotten a conuenient Length and Breadth, (as I haue aboue declared by diuerse Triangles and other figures) then you shall enter this Table. Seeke there the Length, and most number of Pearches in the higher margine, which beginneth at 1. and endeth rightward at 40. Loke the other summe of Pearches (I meane the Breadth) in the right side and hanging margine, from 1. descending to 30. Now at the meeting of the lines, where the one answereth the other directly in a square, you shall find the Acres, Rodes, Dayworkes, and Pearches. Note that the first number set on the left side, and vpper part in any square, signifieth the number of Acres. The figure 1. set in the vpper part, and right side, doth betoken a Rode: the figure 2. there two Rodes, 3. three Rodes. And the figure in the left side beneath, signifieth a Day worke, or day workes. A figure in the lower part rightward, declareth Pearches.

A Declaration adioyned.

What is to be done when numbers, with which you should enter, exceede your Table.

When it chaunceth that the one number or both, with the which ye should enter this Table, are greater then any here found: it behoueth you to take the halfe of the one, and the whole of the other, or what parts ye list of both, most commodious for your purpose, and so enter your Table. Loke then what is there found, and it shall beare his name of the parts multiplied in themselues.

Ensample.

Enſample.

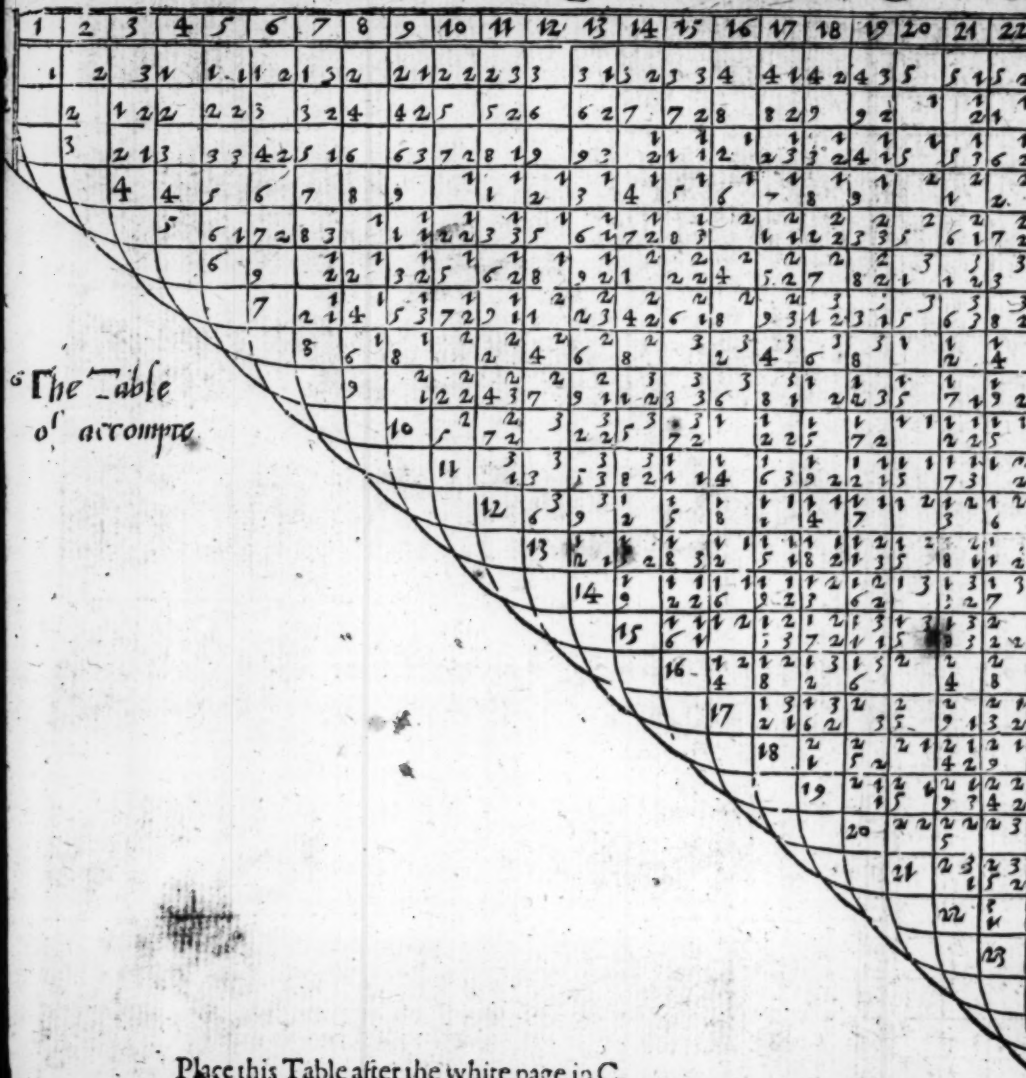
Suppoſe the number with the which ye ſhould enter your Table to be 103. Pearches in length, and the Breadth 60. neither of theſe may be found in the Margines: wherefore I take the third part of an 130. which is 34. Pearches, and one remayneth.

The halfe 60. that is 30. I finde with entring them at the common méeting 6. Acres, 1. Rode, and 5. Day workes. This ſumme muſt haue his Name of the parts augmented in themſelues. I toke the third part of the one, and halfe the other number, therefore 2. muſt be multiplied in 3. or contrarie: ſo haue yée fire, which ſignifieth that yée haue found by entring, but the firt part of the number yée ſhould finde. Wherefore I muſt take this ſumme tofore found (being Acres, 1. Rode, and 5. Day workes) fire times as much. So haue yée 33. Acres, and 1. Rode. For the Pearch remayning in the length, recken him in the breadth, (as is afore declared) in the fift Chapter of the Remaines: ſo haue yée 60. Pearches more to be added. So the encreaſe of theſe two numbers, 103. and 60, amount to 38. Acres, 2. Rodes, and 5. Day workes. Thus anymaner Length and Breadth is reduced to this Table following, which ſufficeth.

Looke what I haue ſhewed in the chapter of parts, that vnderſtād here of whole Pearches, leaſt ſubtracting, &c.

Thus with few wordes is ended the certaine meaſuring of all maner Land, touching the Superficiall Contents. Wherefore now ſhall follow the true meaſuring of Timber, Stone, Stæples, Pillars, Globes, according to their Craſſitude.

Such as are altogether ignorant of Arithmetike, may recken by our Engliſh coyne, allowing for every Pearch in length or breadth a penie, and ſo every Parke makes an Acre, every Noble halfe an Acre, every fortie pence or halfe Noble, a Rode, and every pennie a ſquare Pearch. And ſo by memorie without Tables, may in ſome rude and groſſe maner, caſt vp reaſonable iuſt the true contents of all Cloſes, Medowes, Parſhes, Hilles or Valleys.



The Table of accompte

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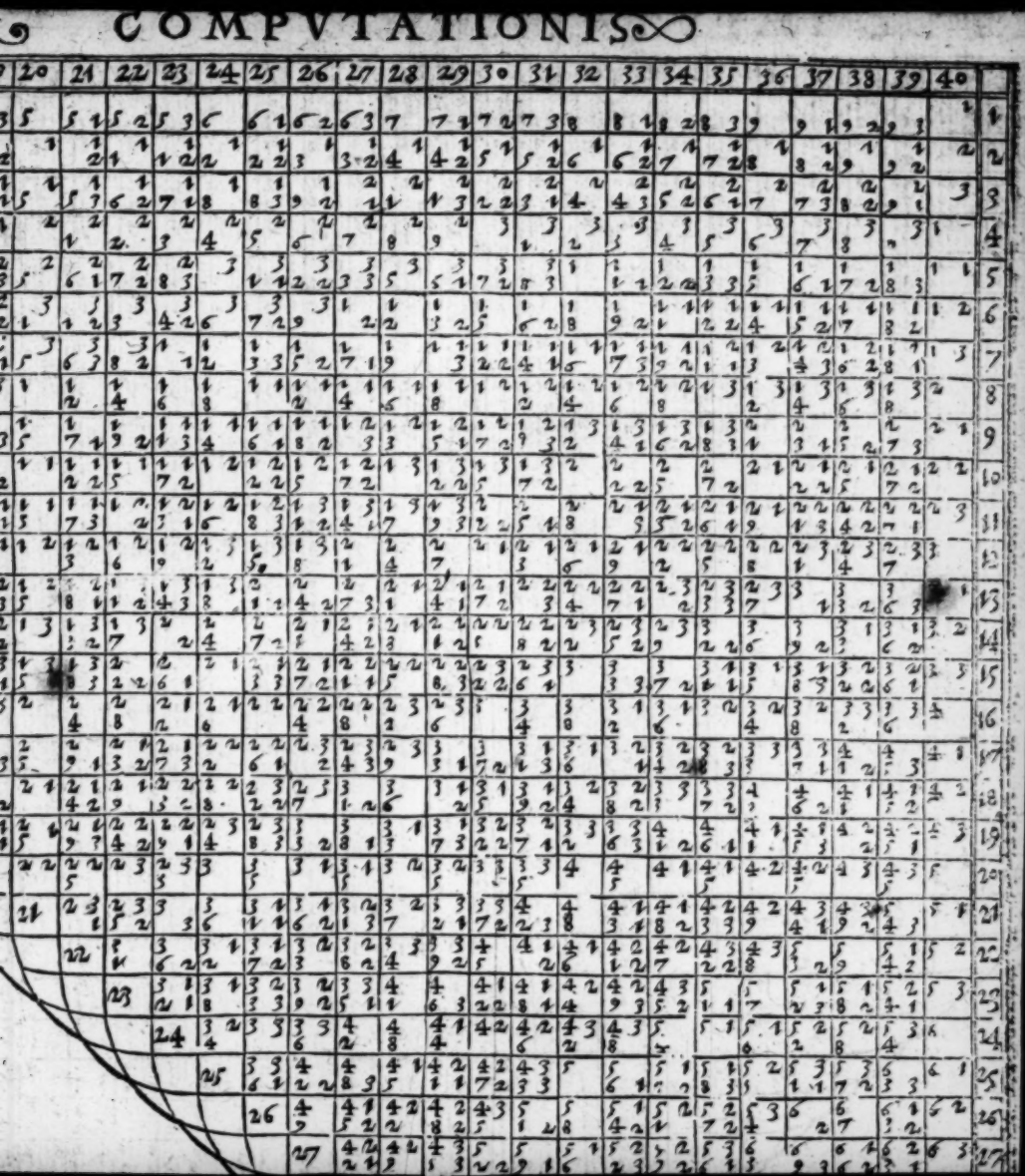
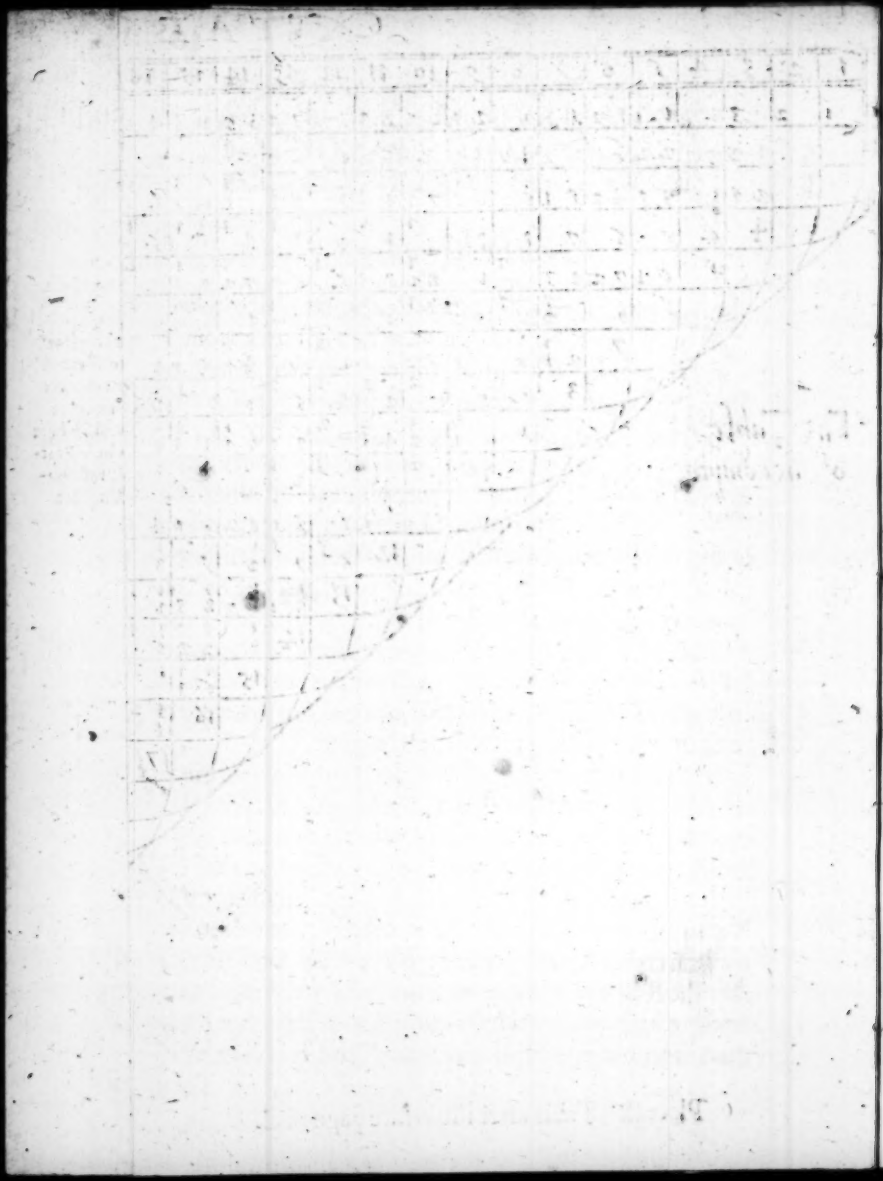




To the Reader.

IT commeth commonly to paſſe, that Carpenters, Maſons, and ſuch like Artificers, are put either to meaſure timber euery way ſquare, or ſquared logs, broader on the one ſide then on the other: yea, many times mutilate or vnperfect ſtuffe. Sometimes three, fiue, ten, or twentie ſquare in the head, and ſo through: oftentimes round Stone or Timber with hollowed, &c. Afore I ſhew vnto them what muſt be done with ſuch peeces of Timber or Stone, to get their true meaſure; my deſire ſhall be, that ſuch Craftſmen will leaue to be headie or ſelfe willed: yea ſo greedily to ſticke to their corrupted rules, that vtterly they refuſe to be taught.

Both learning and experience declareth vnto me, that the Grounds which the beſt of them haue, are falſe. To open how and where, it needeth not: neither doth it appertaine to inſtruction, onely it may ſuffice him that liketh the true way, here to receiue it appointed to him. Yet to ſatisfie and content him which will not beleeue any ſuch errors or falſe grounds to be, I ſay (and truely) that the Ruler of Timber meaſure, which the moſt part of them hath, is not made by right Art. Beſides that, their craft in ſeeking the Square of ſome Timber is very falſe.

They

They vſe in meaſuring, to lay the broader and narrower ſides togither in a ſumme, and to take the halfe of that number for the Square. Then they ſeeke this vntrue Square vpon the falſe Ruler, and ſo meaſuring the Timber, they conclude of it vntruely.

As this is corrupted, ſo are other Grounds which they take to be infallible. Now to the purpoſe: touching the correction of thoſe Errors, with other not mentioned, whereby true meaſuring may enſue, this way ſhall be taken. After I haue opened how you muſt handle all ſuch faſhioned Timber (as afore is ſpoken of) there ſhall follow a Table, in which ye may find (as I will declare) the Square of any Stone or Timber. That knowne, it is requiſite to haue another Table immediately following, which may appoynt to all true Squares from 1. to 6. inches, the iuſt length to make a Foote euery way ſquare. With the length agreeable to your Square, your Logge muſt be meaſured. And as oft as yee find it from the one ende to the other of your Timber, ſo oft yee may conclude the Foote ſquare to bee contayned in that timber Logge, or Stone: that is, ſo many ſquare Feete there to be included. This Table of Timber meaſure ſtandeth in the place of a good Ruler, well decked with true meaſures. By this yee may make or correct Rulers at pleaſure, as after appeareth.

In a Foote ſquare is contained 172. Inches.

Now orderly followeth the true meaſuring of all faſhioned Timber or Stone aforenamed.

How Timber or Stone foure square euery way, or broader on the one ſide then on the other, is meaſured.

The vij. Chapter.

IF a péece of Timber or Stone, be either equally ſquare, broader on the one ſide, then on the other, yée ſhall take the iuſt meaſure, I meane, how many Inches the broader ſide containeth: euen ſo of the narrower. This done, yée muſt looke in the Table of ſquares following, the meaſure of the broader ſide of the Timber or Stone, in the vpper margine of that Table. Then looke for the number of Inches, of the equall or narrower ſide in the right part and hanging Margine. At the common meeting where the one number anſwereth directly to the other, there your true Square ſhall appeare. This Square ſo found, ſhall be referred to your Table of Timber meaſure: in the which yée may plainely ſée (if you runne downe by the left Margine, vntill your Inches ſquare appeare) how many Féete or Inches of your Ruler belongeth to a Foote ſquare. As often as that meaſure there found is contained in the Timber or Stone, ſo often and as many Féete ſquare yée may conclude (without doubt) the péece of Timber or Stone to haue.

Ensample.

Suppose this squared Timber or Stone a.b.c.d. were to be measured, the broader side a.b. 20. Inches, the narrower side b.c. 13. Inches, the length 49. Inches. Now I must seeke the broader side 20, in the upper Margine of the Table. The narrower side 13, must be found in the right side and hanging Margine. At their common meeting, 16. Inches, and ½. part of an Inch shal appeare. This true square must be searched for in the Table of Timber measure. Therefore looke for 16. in the Margine of this Table. In the Squares with him rightward, ye shall finde 6. Inches, and ½. which is three quarters of an Inch, some deale lesse of your Ruler then 6. and ½. laid out upon the Timber, maketh a Foote Square. And that measure so directly handled, is contained in the Length of your Timber five times. Wherefore affirme five Foote there to be, besides that is left ½. part of a Foote. Note because the Squares at all times, (in this Ensample) rise not to even Inches, but sometime to odde parts: therefore according to your discretion, adde or take away some part more or lesse in setting forth the Foote Square, as above is performed.

It were intollerable tediousnesse, yea impossible to set forth the true quantities of Timber measure, to all odde Quantities of Squares. The discrete handling of these, the wittie shall bring to a sufficient exactnesse.

Of Timber or Stone, 3.5.10.20. or moldes Square, &c.

The viij. Chapter.

When Timber hath diuerse equal Squares in the head, and so through: first measure all the square sides round about the head or end of the Timber. Then take halfe the number of the whole measure for one breadth.

Then measure from the Centre (which is the middle of the head, or end of the Timber) to the middest of the Square side, betweene the two Angles, and take the measure of that distance for the other breadth. Now resort with the measures of these two breadths, (as before) to the Table of Squares: séeking the bigger number or breadth in the vpper Margine, and the other lesser in the side Margine. With the Square there found, haue recourse to the Table of Timber measure, and doe as I haue instructed.

Ensample.

Admit this small péece of Timber fiue square, e.f.g.h. should be measured, euery side being 12. Inches. If ye adde togither in one summe all the fiue sides, they make 60. Inches. The halfe is 30: that serueth for one breadth. Then the Line e.f. which goeth from the Centre or middest of the Square to the middle of one side, is 8. Inches. The two numbers 30. and 8. must be sought (as before) in the table of Squares following. At the common meeting, your square shall appeare 15. Inches, & ½. This square 15. séeke in the Table of Timber measure. There yée may sée right with it 7. Inches, and ½. Now because of ½, the odde quantitie of the

Square aboue 15. Inches, lay ſomething leſſe. Then ſée how oftentimes that meaſure (ſo with diligence vſed) is from the one ende of your Timber to the other: and affirme ſo many times a Foote ſquare there to be, as that meaſure is found in the length of your Logge.

How round and hollow Timber, Steeples, Pillers, Globes, &c. are to be meaſured.

The ix. Chapter.

FIrſt gird the Logge round about with ſome Line: then diuide the Line which compaſſeth that timber in two equall parts: kéepe the one part for the bigger Breadth. After, ye ſhall diuide againe that whole length (the two and twentie part caſt away) in three parts, and take the halfe of one of them for the other narrower breadth. With the meaſures of theſe two breadths, haſt to your table, performing all things as afore is opened.

Enſample.

Suppoſe this little péece of Timber i. k. l. m. were to be meaſured, the compaſſe or girding 36. Inches, the halfe of that is 18. being the one breadth: then the third part of 36. is 12. the halfe of it is 6. which is the other narrower breadth, with theſe two numbers 6. and 18. enter the Table of Squares following, and ſo the Table of Timber meaſure. At the laſt (all things perforemed as before) ye ſhall find in this round Log, the length l. m. being 18. Inches, 1. Foote, and ½ part of a foote. This is ſufficient for all ſuch like.

A note of hollowed Timber.

IF it chaunce that hollowed Timber be to be measured: measure the whole Logge as though it were not hollow, as aboue is declared. Then measure the narrower and broader side of the hollow, and see what is contained in that, as though it were masse Timber. Now pull out the Content of it, from the whole aboue measured: the remaine of force must shew what Timber is included in that hollowed body.

I Am vnable in fewe words to expresse to the vnlearned, by what meane Pyramidall, or picked regular Steeples of all fashions are measured. Also how Pillers, how the Content of Globes or Bawles are searched, vnlesse the Art of numbring were tasted. That being knowne: thus (as now followeth) I teach.

How the crassitude of picked Steeples is knowne.

MUltiplie the plaine of the Base in the third part of the Height: so ye haue the Crassitude. Or multiplie the Content superficiall (found as I haue instructed) in the Height of the Steeple, taking for your purpose the third part of that product.

How the Content of Pillers is knowne.

ENcrease the Base plaine in his Altitude or Height: so haue ye your desire.

How the Cubicall bodies of Globes are searched.

The Content Superficiall found, (as I haue opened) must be multiplied in the firt part of the Diameter: the product is that ye require. Or the third part of the superficiall Content in halfe the Diameter. Or multiplie the plaine of the Circle in the whole Diameter: then take two third parts, which added, make the Crassitude.

Of the halfe Circle.

His Superficiall Content multiplied (as I said) bringeth the magnitude of him. If any man require ensamples of these last matters, or more sufficient handling: let them resort vnto my bookes published of Geometrie, where they shall be satisfied. These little appertaine to Carpenters or Masons: therefore not by ensample declared.

A generall note.

When thou shalt be put to measure some Bodie, without order or fashion, lacking part of his Square, or hauing more then his Forme: if it lacke, thou shalt make it perfect by obseruing diligently the running together of the sides. The parts wanting shall be measured, as though they were there, which portions must be taken from the whole Bodie measured.

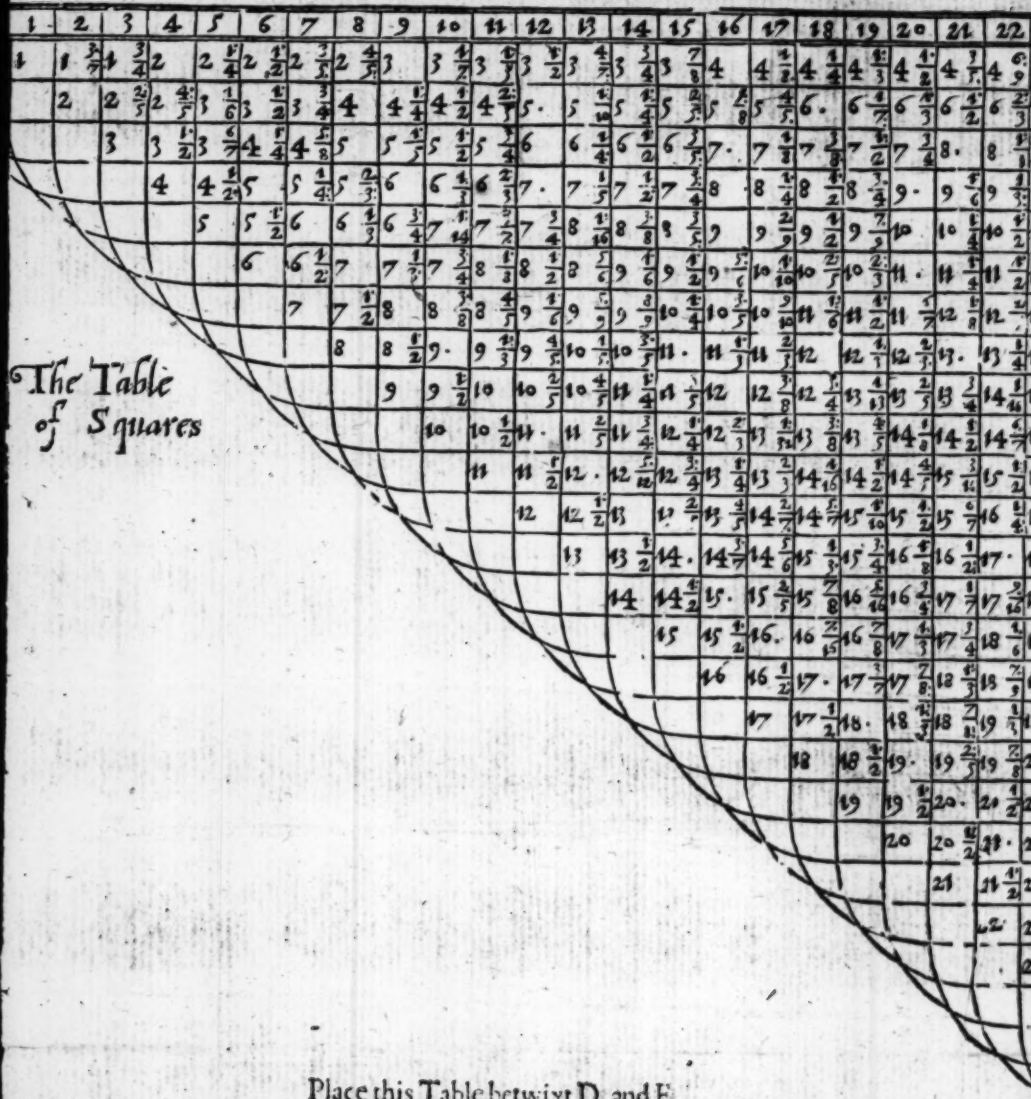
Also when there resulteth any more then the forme or Regular Square: first measure the square Bodie: then the Crassitude which aboundeth. All put together, doe shew the whole irregular Bodie. This sufficeth.

A Table to find the iuſt Radix or Square of any Timber or Stone.

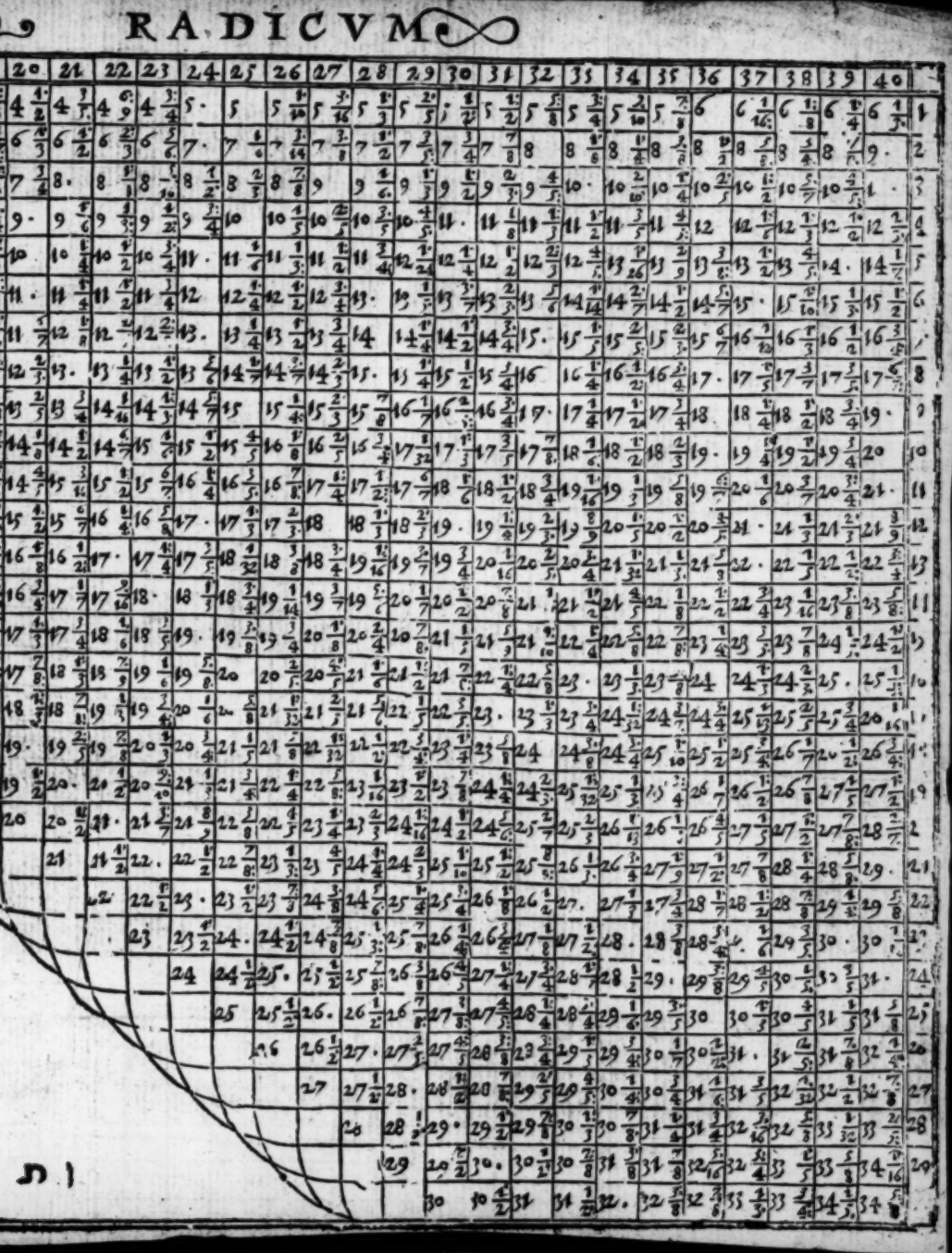
IT behoueth you to know that this Table following is made for the true ſquare of any maner timber. Therefore vnderſtand that the numbers from 1. to 40. ſet aboue in the high Pargine, betoken the inches of the broader ſide of the timber. And the numbers from 1. and ſo downward to 30. put in the right part ſ hanging Pargine of this table, ſignifie the inches of the narrower ſide: ¶ to conclude briefly, the Element or figures ſet in euery ſquare rome, betoken the iuſt ſquare. The bigger figures leftward in euerie ſquare place, ſignifie the whole inches. And the other leſſer rightward in the ſame ſquare diuided by a line the parts of inches, as $\frac{1}{2}$. &c.

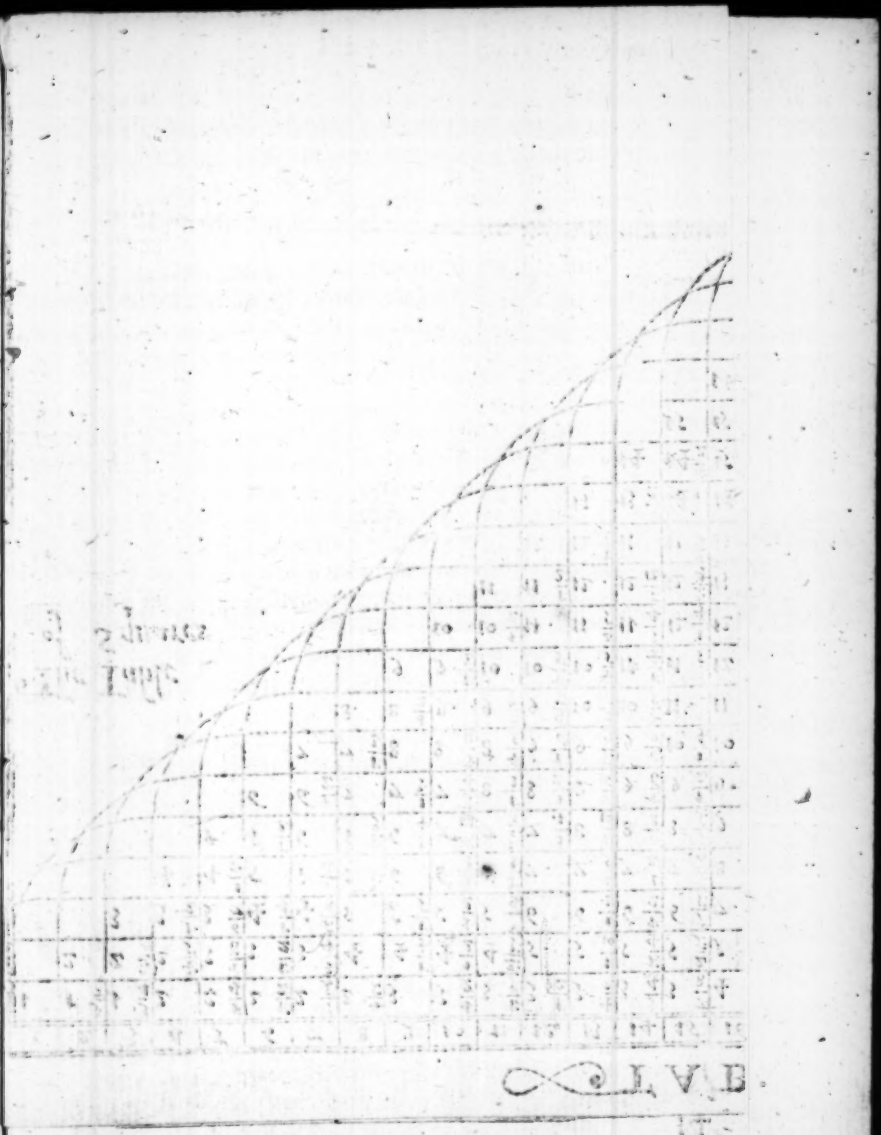
This firſt Fraction toward the left hand betokeneth one halfe part of an inch: the other two fifts of an inch, and euerie figure or fraction hauing a point adioyned vnto him, ſome deale leſſe then that part is: as this part, $\frac{1}{2}$ repreſenteth ſcant halfe an inch, a very little quantitie leſſe. And if it had two pricks by him, he ſhould haue declared ſome quantitie more: as this other fraction or part, $\frac{1}{2}$: which is more then two fifts, a ſmall deale.

It had not been needfull to haue put the parts of the Square ſo preciſely as they are here: neither is it requiſite ſo curiouſly to take them.



Place this Table betwixt D. and E.




A
B

The x. chapter.

THis Table (as ye see) is deuided into two Columnes or Rowes: the one very short, the other longer. In the heade of the first, I haue put this word foote: in the second Rowe, Inches, and parts: to signifie Feete, Inches, and parts of inches. The summes in the Margine and left part of the first and second columne, declare the quantity of the square of Timber or Stone, from 1. to 36. Inches square. Within the Rowes you may find the iust length to a foote square, if yee enter into them in right order according to the square.

Example.

SUppose the square of your Timber were 7. Inches, and that ye desired to know what measure or length of the Ruler would make a foote square: seeke in the left margine, seuen Inches: and with him in that order toward the right hand, ye shal find 2. foote. 11. Inches, and ;. of an Inch. Note because the fraction ; hath a pricke by him, it betokeneth some smale quantitie lesse then ;. of an Inch. If it had 2. prickes or poynts thus :; it should signifie som little quantitie more. Neither maketh it matter whether ye obserue this pricking or no, the quantitie is so little to be added or pulled away.

Note what hath been spoken of Timber, the same also is to be vnderstood of stone, likewise to be measured.

Thus is finished the measuring of Timber.

Now ensueth of boord.

How Tables, Boords, Glasse, or any such like, are measured, according to their length and breadth, onely to the foote square.

The xi. Chapter.

THis thing is performed by the help of a large Table following, diuided in fiue small Tables, and as many Margines. The first and left Margine beginneth at $\frac{1}{4}$. which is one quarter of an Inch, and extendeth to 6. Inches, as yée may plainely perceiue if yée run downe by that Margine. This hath his Table on the right side adioyning vnto him. The other taketh his beginning at 6. Inches, $\frac{1}{4}$. and endeth at 12. hauing his proper Table also. The third from 12. $\frac{1}{4}$. to 18. And so from 18. $\frac{1}{4}$. to 24. from 24. $\frac{1}{4}$. to 30. The last Margine is from 30. $\frac{1}{4}$. to 36. and there endeth.

Of this that is sayd, you may gather that euery Margine hath his Table on his right side. Also you must know that in the top, and beneath, I haue put (as in the table of timber measure) these words Foote, Inch and Parts, to signifie Féete, Inches, and parts of an Inch. Whensoeuer ye list to measure Bord, Glasse, or any other such, with the Breadth of it, enter this Table, and séeke that Breadth in his proper Margine: there ye shall find in right order how many Féete, Inches, or parts of an Inch, belong to a Foote square. So often as the measure is in your stuffe, iust as many Féete haue yée in that Bord, or such like. If the Breadth excéede this Table, then deuide the Breadth in parts, and worke as is and shall be declared. So the ingenious applyeth this Table for all maner breadths, most exactly.

Example.

Fo	Yn	Fo	Yn	Yn Par	Yn Par	Yn Par	Yn Par
48		6 1/4	1 11 4/5	12 1/4	11 3/4	18 1/4	7 7/8	24 1/4	5 15/16	30 1/4	4 3/4
24		6 1/2	1 10 1/5	12 1/2	11 2/5	18 1/2	7 4/5	24 1/2	5 7/8	30 1/2	4 5/7
16		6 3/4	1 9 1/5	12 3/4	11 2/7	18 3/4	7 2/3	24 3/4	5 4/5	30 3/4	4 2/3
12		7	1 8 4/7	13	11 1/15	19	7 4/7	25	5 3/4	31	4 5/8
8	7 1/2	7 1/4	1 7 7/8	13 1/4	10 7/8	19 1/4	7 1/2	25 1/4	5 2/3	31 1/4	4 5/8
8		7 1/2	1 7 1/5	13 1/2	10 2/3	19 1/2	7 3/8	25 1/2	5 5/8	31 1/2	4 4/7
6	10 2/7	7 3/4	1 6 4/7	13 3/4	10 2/7	19 3/4	7 2/7	25 3/4	5 5/8	31 3/4	4 1/2
6		8	1 6	14	10 2/7	20	7 1/5	26	5 1/2	32	4 1/2
5 1/4	4	8 1/4	1 5 3/7	14 1/4	10 2/13	20 1/4	7 1/8	26 1/4	5 1/2	32 1/4	4 1/2
4	9 3/5	8 1/2	1 4 15/16	14 1/2	9 7/8	20 1/2	7 1/2	26 1/2	5 3/7	32 1/2	4 3/7
4	4 2/3	8 3/4	1 4 2/7	14 3/4	9 3/4	20 3/4	6 15/16	26 3/4	5 3/8	32 3/4	4 3/8
4		9	1 4	15	9 5/8	21	6 6/7	27	5 1/2	33	4 1/3
3 3/4	8 1/3	9 1/4	1 3 4/7	15 1/4	9 3/7	21 1/4	6 4/5	27 1/4	5 2/7	33 1/4	4 1/3
3 1/2	3 5/8	9 1/2	1 3 1/7	15 1/2	9 2/7	21 1/2	6 5/7	27 1/2	5 2/7	33 1/2	4 2/7
3 3/4	3 2/5	9 3/4	1 2 3/4	15 3/4	9 1/8	21 3/4	6 5/8	27 3/4	5 1/2	33 3/4	4 1/4
4	3	10	1 2 2/5	16	9	22	6 1/2	28	5 3/8	34	4 1/4
4 1/4	2 9/10	10 1/4	1 2 1/21	16 1/4	8 6/7	22 1/4	6 1/2	28 1/4	5 3/7	34 1/4	4 3/16
4 1/2	2 8	10 1/2	1 1 39/40	16 1/2	8 5/8	22 1/2	6 3/8	28 1/2	5 1/16	34 1/2	4 1/8
4 3/4	2 6 1/3	10 3/4	1 1 3/8	16 3/4	8 5/8	22 3/4	6 1/3	28 3/4	5	34 3/4	4 1/8
5	2 4 4/5	11	1 1 1/11	17	8 1/2	23	6 1/4	29	5	35	4 1/8
5 1/4	2 3 9/11	11 1/4	1 1 4/5	17 1/4	8 1/2	23 1/4	6 1/4	29 1/4	4 7/8	35 1/4	4 3/32
5 1/2	2 2 1/5	11 1/2	1 1 2/7	17 1/2	8 7/16	23 1/2	6 1/8	29 1/2	4 7/8	35 1/2	4 1/16
5 3/4	2 1 1/23	11 3/4	1 2/7	17 3/4	8 3/22	23 3/4	6 1/16	29 3/4	4 5/6	35 3/4	4 1/32
6	2	12	1	18	8	24	6	30	4 4/5	36	4
Fo	Yn	Fo	Yn	Yn Par	Yn Par	Yn Par	Yn Par

Enſample.

Suppoſe I haue a pane of Glaſſe or a Boord, whoſe bredth were 22. inches, $\frac{1}{4}$. the length 16. foote. In the fourth Pargine, I find this bredth, 22, and $\frac{1}{4}$. And euen with it in the Table rightward, I ſee 6. inches, $\frac{1}{4}$. So much of my Rules wanting ſome ſmall quantitie, maketh a foote.

Now becauſe in the length of my Boord (which is 16. foot) that meaſure is found 29. times, and $\frac{1}{7}$. parts: I conclude 29. foote there to bee, and two third parts of a foote Square, according to the length and bredth. I ſaid (wanting ſome ſmall quantity) becauſe of the point ioyned to this fraction $\frac{1}{7}$. which is put to diminiſh the fraction ſome little thing, as is declared plainely in the other Tables before put forth.

HE that deſireth to meaſure chamber floores, Pauemẽts, or ſuch like, let him onely multiplie the bredth with the length, ſo the product ſheweth the Content.

Enſample.

IF there were a pauement 100. foot long, and in bredth 50. I muſt needes conclude (by multiplication of the length in the breadth) there to be contained 5000. foote.

Or thus without Arithmetike, when the bredth exceedeth the Table.

DIuide the bredth in parts (as is opened in the Declaration of the Table of account) and worke as I haue before inſtructed. So for Pauements all manner wates it ſerueth your turne. Of this matter to put forth Tables, were ſuperfluous tedioufnes and folly. The ingenious with theſe few, will be ſatiſfied.

The Carpenters Ruler.

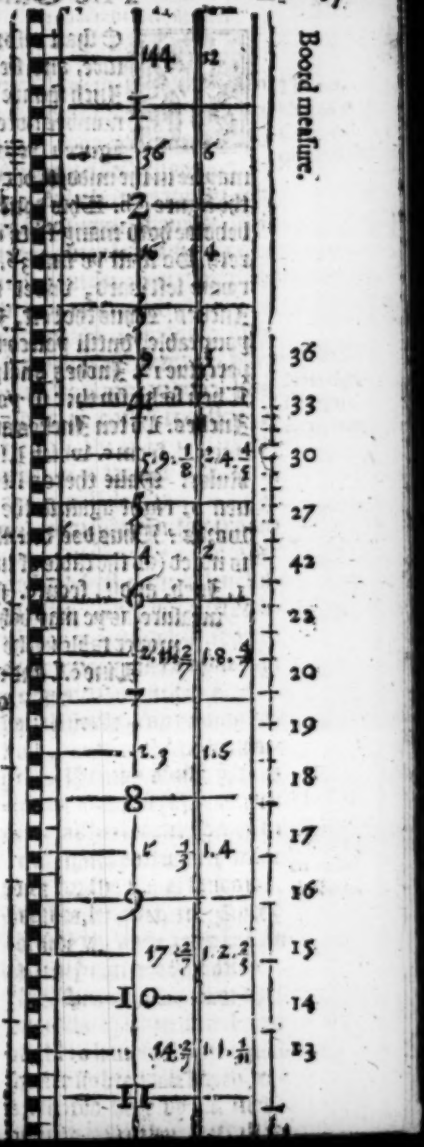
The fyfte of the Carpenters Ruler, figured with the true measures, and other things necessary.

The xiij. chapter.

BEcause the effect of this ruler is aboue declared by tables, an instrument also well knowen and common among good Artificers, I will not spend many words in opening it. Behold the figures & learne by the how ye ought to make, and commonly to decke your Ruler, both with timber and boord measure.

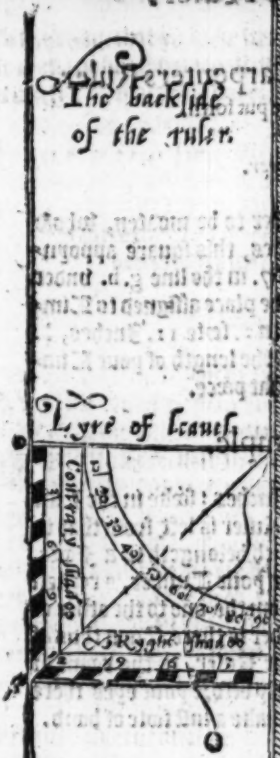
An Example.

Admit the Ruler to be a.b. c.d. well plained, 12. Inches long, a quarter of an Inch thicke, & two inches in breadth. Truely it were more commodious, if it had two foote in length. This ruler here imagined, but a foote in length is deuided first in 12 euen parts called inches: then euery inch in halfe, or two equall portions: each half in two quarters: euery quarter in foure or 2. parts at the least: as in this ensample. Then are the figures placed from 1. to 12. manifesting the inches. Thus your Ruler is ready to receiue the measures which are marked or fi-



We shall resort to your Table of Timber measure, and seeke how many feete belong to one Inch square: there ye shall finde 144. This number note, write, or rather graue, where this figure 1. representing one Inch, is figured as ye may see in the middest betweene the Line e.f. and the Line of the figure g.h. This done, resort to your Table againe, and beholde how many foote and parts 2. Inches square requireth. So shall ye find 36. Foote, which is placed in the next rome leftward, vnder the Character 2. signifying two Inches. Thus thereof, Foote, Inches, and parts, found in your table, vntill you come to the 12. Inch, where ye shall perceiue 12. Inches onely to be set in his proper rome, &c. Then seeke further in your Table what belongeth to 13. Inches. Lo ten Inches and 1. This must be numbred in the line c.d. from c. which Line betokeneth the thicknesse of the Ruler. Make there a little strike, vpon that grossenesse, euen or right against the measure 10. What neede many wordes? Thus doe vntill you come to 36. Inches, and that is noted (as the table of timber measure sheweth) right with 1. Inch, and 1. foote. No otherwise is performed of bord measure, as ye may beholde, set forth by the helpe of his proper table in the Square comes beneath the Line e.f. and also the other thicknesse or Line c.d.

The xiij. Chapter.



THis other figure i.k.l.m. is ỹ backside of your ruler, hauing in the middest of Geometricall quadrant n.o. p.q. whose making in few words is thus expressed. The line or breadth of your ruler n.o. ỹ line o.p.p.q.q.n. ought to be of one equall full length, cutting eche other squire wise. And from the centre n. vnto p. is drawen another line, which is called the line of height. So is o.n. the line of leuel, q.n. the line of heights vpright. This known I ope my compasse, one foot remaining. In ỹ centre n. the other extended in the line of leuel almost to o. making a circumference to q.n. which is a portiõ of a circle named a quadrãt: e ought to be diuided into 90 equall parts, as ye may behold, euery of thẽ called a degree. Ye may diuide ỹ lines o.p.p.q. named the Scale, eche in 12. as here, or in 60. yea in 100. equall portions is more meet for the vse of shadows, heights, lengths, &c. Note ỹ the side or halfe scale o.p. is called ỹ cõtrary shadow p.p. right shadow. Remember that vpon the thickneſſe m.k. yee ought to haue two fine equal square sights well bored, representeed here by r.s. made of lumd. or rather mettall to

The line of height vpright.

R

The making of a Geometricall quadrãt.

Note these three principall lines.

The deuided sides o. p. and p.q. are called the Scale.

The common vſe of the Carpenters Ruler, touching the Face afore put forth.

The xiiij. Chapter.

The eight Chap. ſheweth how the true ſquare is found.

SUppoſe a peece of timber to be moaten, whoſe true ſquare is 7. Inches, this ſquare appoynted you to the figure of 7. in the line g. b. vnder whom rightward in the place aſſigned to Timber meaſure, is written 2. foote 11. Inches, $\frac{2}{7}$. As often as that meaſure is found in the length of your Timber, ſo many foote of Timber is in that peece.

Another Example.

IMagine your Square to be 22. Inches: ſeeke in the Line a.c. Note then how much of your Ruler is left from that to the ende of your Rule c. and ſo much belongeth to a Foote. Therefore lay out the meaſure vpon your Timber, & reckon how many times ye may find it, from the one to the other of your Log: for ſo many foote of timber is there. Euen thus of bord. Seeke the breadth vpon your Ruler, in the rome or place of bord meaſure, & immediately before your eyes there remaineth what is to be laid out to make a iuſt foote of bord.

The vſe of the principall lines in the Geometricall Quadrant on the backeſide of the Ruler, and firſt of the leuell Line.

The xv. Chapter.

IT behoueth you to loke through your ſights q.n. placed in the thickneſſe of line k.m. a fine thred and plummet falling a libertie out of the Centre n. If this plummet and thred chaunce preciſely on the line of leuel (which is n.o.) whatſoeuer ye ſee through the ſights, is leuel with your eie: if otherwiſe

wiſe the thing that ye looke vnto is not leuell, either more or leſſe then the height or leuell of your eye. More if the plummet fall to your ward: leſſe, if contrarie.

How by the line of Leuell to foreſee whether the water of any ſpring or head is poſſible to be brought to a place appointed, and alſo to iudge the holſomnes of it.

The xvi. Chapter.

YE ſhall goe to the head or ſpring, and ſet your Ruler to your eye (being in height equall with the water) ſo that the line corde and plummet fall preciſely in the line of leuel. Now if through the ſights ye may ſee aboue the place, know and iudge the water poſſible to be brought, if your ſight fall vnder: impoſſible. It commeth commonly to paſſe, when the place to the which ye would haue water conueyed, is of any great diſtance from the head, then Hilles, Valleys, and ſuch like impediments, let the Line viſuall to haue his due courſe: wherfore this remedy is prouided. At the head of the Spring, ye ſhall looke thorow the ſights (as before) and note a marke in the next Hill toward the place, then goe to the marke in like maner obſerue another in ſome hill: ſo forth vntill by any of them ye may perceiue the place deſired. If then your ſight running through the pinnes of your Ruler, (the third euer falling on the Line viſuall.) preceede that place, the conueying of your water is poſſible. Otherwiſe not.

Now by the way briefly ye ſhall be inſtructed how ye may know the holſomneſſe of water.

How good water is knowne.

TAke a cleane pot, and put water in it: ſo ſet it on the fire: after a little boyling, powre it out: if then no filth remaine

maine in the bottome of the pot, it may be iudged the holſo-
mer. Or thus. Let fall drops vpon metall, or rather on
Glaſſe (any of them being poliſhed) and ſuffer that to drie
by it ſelfe, if after there remaine no ſpot or ſigne, it is a good
token. Moreouer, if your water be ſweete, pure, cleare,
light, or of little weight, it followeth the water to be hol-
ſome for the vſe of man.

Of the Line of height.

WHenſoeuer the Thred and Plummet doe chaunce iuſtly on the Height, which is n.p. the Altitude or height that ye ſee is euen with the diſtance from the middle of your Foote, to the nether part directly vnder the toppe, equall with your ſtanding, adding the height of your Eye downeward. Knowe that ye muſt euer ſtand vpright with bodie and Necke, your Feete iuſt together, the one Eye cloſed, &c.

The Line of vpright Altitudes.

IUdge alſo any thing plumbe vpright when the thickeneſſe of your Ruler i.l. is cloſely thereon, the plummet then at Libertie falling on q.n. named the Line of Heights vpright. Now followeth the vſe of the Scale.

To ſearch out Heights by the Scale with the ayd of two places.

The xviij. Chapter.

LEt the Thred and plummet fall in the one, on the 12. poynts: in the other Station, on the 6. of the right ſhadow: double the diſtance betweene the two places, the ſummitie appeareth from that part of the thing meaſured, which is equall in Height with your

eye.

eye. Or the one in the 12. the other in 8. of right ſhadow: then triple the diſtance. The one in 12. the other in 6. of right Quadruplate, the ſpace. The one in the 12. the other in 6. of the contrarie ſhadow, then the ſpace betweene both the Stations is equall with that yée meaſure, euer vnderſtanding from your eye vpward. Euen that ſame commeth to paſſe, if in the one the Threed be found vpon the 6. of the contrarie, in the other on the 4. of the ſame, or the 4. and 3. of the contrarie. In all theſe the ſpaces are equall with the Altitudes. So then in meaſuring the diſtance betweene the two places, yée haue the height from your eye vpward, putting to it the length from your ſight downeward, the whole Altitude appeareth: the Baſe being equall with your ſtanding.

I would not haue you ignorant heere how to knowe lengths which bée in height not eaſie to come vnto. For (as before) get the height of the toppe, the Altitude of the Baſe or longeſt part of your length. Subduct the leſſe height out of ỹ more, of force your deſired length remaineth. Or thus: Let the plummet and threed fall in the 12. Marke your place: goe in toward the thing (the threed as it was) vntill ye ſée the Baſe of that length: the diſtance betweene the two ſtandings, is vndoubtedly the Length. How lengths in height are knowne.

How with the Scale direct or vpright heights by their ſhadowes are declared.

The xix. Chapter.

Turne your left ſide vnto the Sunne, ſuffering his Beames to pearce both your ſights q. r. placed (as afore is ſayd) in the thickeneſſe or line k.m. The Threed or Plummet then hanging at libertie, out of the Center n. ſheweth as well the Degrées

of height to be counted from o. as the parts of the Scale cut. If your thred be found in the 12. part or line of leuell, shadowes of all things being perpendicular elevated, are equall with their bodies. If the plummet with the thred be perceiued, cutting the parts next to the sights, which I name poynts of the right shadow, then every thing directe is more then his shadow, by that proportion which 12. exceedeth the parts, where the thred was found. If it fall in 1. that is the first part of the right shadow, take the shadow twelue times to make the height. In two, that is the second part, five times, in the third, foure times: in the fourth, three times: in the fift, twise: and ½. of the shadow, in the first, twise, in the seuenth once, and ½. in the eight once, and ½: in the ninth once, and ½: in the tenth once, and ½: in the eleuenth ye shall take the shadow once, and ½. part of it.

Right shadow. If the Arte of numbring were had, I would will you to multiplie the length of the shadow by 12. and the product diuide by the parts in the which ye found the thred.

Contrarie shadow. But and if it be in the parts of the contrary shadow, augment the length of the shadow with the parts declared by the plummet: and the encrease diuide them by 12. so commeth the altitude also.

Thus the composition and whole appliance of the Carpenters Ruler is shewed: therefore somewhat shall be now said of the Squire.

I am not ignorant that the common vse of him, is better knowne then I can with many words expresse, wherefore I leaue to write in that behalfe. Notwithstanding I will declare how Heights and Lengths are taken, &c. matters rare and knowne of few Artificers.

Also by tables to get a true knowledge of the day houre, and that diuerse waies, with the helpe of the Squire, as is opened in my generall Prognostication, augmented in the yeare of our Lord 1556.

What length the sides of thy Squire ought to be, and the diuision of him.

The xx. Chapter.

I Nede not to put forth the exact making of this Instrument so well knowne. Lo therfore the figure One side supposed two foote from the inward Angle: and the other a foot foote from the same. The longer a.b. inwardly diuided from the Angle a. vnto b. into 24. equall principall parts, and euery of them into a lesse (if ye list) each containing 10 minutes. Also the side c.d. in the outward contrary, plaine from the top c. vnto d. is diuided into 12. euen portions: and againe (if ye require exactnesse) euery of them into 6. each of value 10. minutes: Beholde a line and plummet falling from e. to f. a Parallell to c.d. and a.b. Thus this squire is well framed for the vse of diuerse Tables put forth in my generall Prognostication, and also for the finding of Altitudes and Longitudes, which here I purpose now briefely to open.

How by the Squire heights are knowne.

ALtitudes or heights are found, the line or plummet centred in the first poynt, cutting b. the middle of a.g. The

moueable ſights placed in a. g. or a parallell from that line, not vnlike, as is opened of the line of height, in the backe of my Ruler.

How Lengths in plaine Ground are ſearched by the Carpenters or Maſons Squire.

The xxj. Chapter.

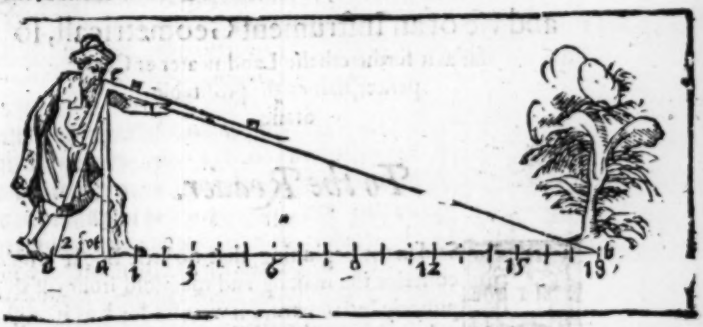
TAke a ſtaffe diuided into certaine portions as ye liſt, in a 100. or a 1000. parts. At the beginning of your length, vpon the very top direcly ſtanding, ſet the inward Angle of the Squire: lift vp or put downe this inſtrument, vntill you ſée the furtheſt part of your Longitude, I meane vntill your ſight running from that Angle, to the end of your Squire, come vnto the furtheſt part of that length. The Squire ſo remaining, and the Staffe not remoued from his height. Marke where the other ende of the Squire next vnto you noted vpon the ground. Sée what proportion the Staffe then beareth to the part of the ground, which the neareſt end of the Squire poynted vnto from the Staffe: the ſame ſhall the Length haue to the quantitie of the ſame Staffe.

Example.

The cauſe is taken out of Euclid 33. pro. 1. booke and the 4. pro. 6. booke.

THe Staffe a. c. in this figure is imagined 6. Fote, and the ſpace a. d. 2. Fote. Conſidering now that 6. the length of the Staffe containeth 3. thrile, therefore the Longitude deſired, a. b. of force muſt containe three times the Staffe (which Staffe is 6. Fote) that maketh 18. Fote. As this is proued true by a ſmall Ground in the figure following: ſo the arte failleth not in a greater ſpace, which the good Speculator

Speculator and diligent Practiſer by any way cannot benie. Yet experience willeth me this to confeſſe, that the Squire is not conuenient for any long diſtance, but the Inſtrument Geometricall (whoſe making and vſe ye may perceiue in the Treatiſe following) vnleſſe ye aſcend ſome Tree or Turret for your ayde, which length knowne, ſhall ſtand in ſtead of your Staffe.



A Note.

IT behoueth yor to haue a fine cord, made faſt in the vpper part of your Staffe c. which ſhall bee tied euen with the inward edge of the Squire, and ſo drawne to the ground, where the neere end of the Square from the Staffe poynted, as yee ſee d.c. the other end then truely directing to the furtheſt diſtance.

Know that the ground muſt be very plaine and leuell, otherwiſe error enſueth.

Thus the vſe of the Squire is here ſomewhat declared, but more in my generall Prognoſtication, yea moſt plentifully hereafter (God ſparing life) in a Booke titled, The rare vſe of the Squire in practiſes Mathematicall. In the which Booke, profitable pleaſant experiences ſhall be plainely opened (onely of me practiſed) as well of Perſpective, as of the Mathematicals in generall.

A little

A little Treatiſe, declaring the making and vſe of an Inſtrument Geometricall, ſo far as it furthereth the Landmeater or Carpenter, named the profitable Staffe.

To the Reader.

I Said in the beginning, that no little Booke would containe the making and manifold fruites of this princely Inſtrument, if it were ſet forth as it ought to be in his perfection. Certes the trueth euen here maketh me confeſſe the ſame: yea, that there is no Inſtrument ſo generall and profitably pleaſant: Notwithſtanding know (gentle Reader) that the occaſion of his chiefe vſe and profite is not here miniſtred: neither to ſay the trueth, doth it appertaine to, or agree with the capacitie of ſuch Artificers. Therfore I ſhall leaue to intreate of his ample large vſe and beſt making, and will ſet him forth in few words: yea, ſufficiently for the Land-meaters capacitie or Carpenters purpoſe, that at the leaſt they may receiue ſome kinde of fruite with the Geometter. And in time to come (by other meanes) as I ſee cauſe, I will largely declare, and there decke him with his proper beauties.

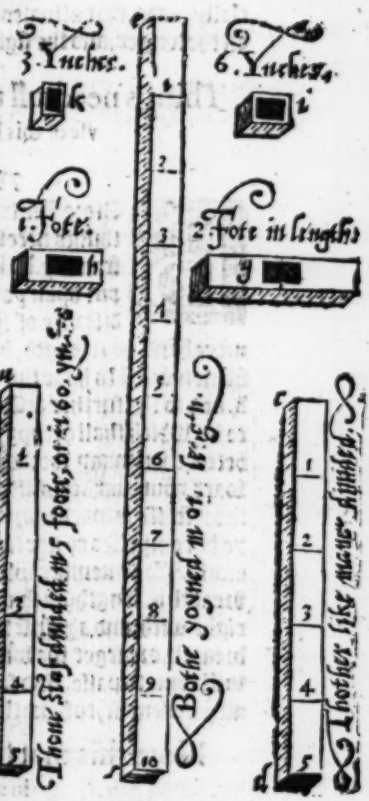
Here now followeth the making, and ſo briefely, how he is applied for the profite of the aforenamed Artificers.

The

The making of this profitable Rodde or Staffe.

The first Chapter.

YE shall prepare two small, streight, stiffe, roūd, or rather square rods, of metall or of wood, well plained, of like bignesse and length. Although it make no matter of what length, yet to auoyde the errors, which little instruments, & short staues bring, and also to beare with the rude vnwonted handling of such Artificers: let your Rods be each fiue, or at the least three Foote, and euery Foote diuided in 12. euen parts or Inches, as ye see a.b. and c.d. These Rods must bee forged with a vice in the end of them to ioyne readilie 10. or 6. Foote in length, (when time requireth) as the figure e.f. sheweth. Also ye must get (by the helpe of some Craftsman) 4. other like Rods, the longer g. 2. foote: the next h. 1. foote: the other i. 6. Inches, then k. 3. Inches, the last and shortest l. 1. Inch, and ½. Each of these must haue in their middest a hole, that the long staffe of 10. Foote may be put through them, and they moued on him at pleasure vp and downe, alwaies cutting the longer staffe e.f. squirewise, and made to tary on any diuision,



as occaſion ſhall be giuen: which all are eaſily to be perceiued by the figure following, although my rude declaration hath not expreſſed my meaning.

Here note in the ſtead of your ſhort ſtaues, yée may haue one croſſe ſtaffe two foote long, with currant ſights, ſo artificially made, that alwaies the ſhort ſtaffe ſhall run ſquire vpon the longer, and the ſights diſtant, as ye liſt to place them.

Things needfull to be knowne before the vſe of this Inſtrument is opened.

The ij. Chapter.

BEfore I intreate of this vſe, it behoueth to know things neceſſary, and firſt which of the 5. little ſtaues g. h. i. k. l. mentioned in the making, is to be put vpon your long ſtaffe a. f. according to the diſtance of the marke. Note if your marke be néere hand, be it length, breadth, or height, the longer g. doth ſéeme méeteſt to haue the roome, if more of length, the other h. and ſo the further diſtance, the ſhorter the ſtaffe requireth to be, which ſhall occupy that place. Oft practiſe herewith this better then many words. Alſo note, if chance be to goe inward your marke (as after ye ſhal ſée how) you muſt moue the ſhort ſtaffe inward more néere to the end of the longer a. If ye be compelled to goe from it, then put it from a. toward the end f. Alſo remember when ye are appointed to meaſure any breadth or length (as ſhalbe declared) it behoueth you to ſtand right with, and againſt that breadth: yea and the longer the breadth, or larger the wideneſs or length is, the better ſ thing will come to paſſe. And for heights it is neceſſary (if ye regard all preciſeneſſe) to haue the beigt ſtand directly vp.

Note this that followeth to be generall in all workings.

YE muſt ſtand right vp with your bodie and in eche, yea Fét iuſt together, your hands not much meaning, the one

eye

eye closed, and euer marke your standing right with the midst of your féete. Be not ignorant here, that I call the extreams of the little staues, the very ends where the sight euer runneth. And no difference betwéene the Altitude and height, betwéene the Longitude and length: the Latitude & breadth. The short staues I name by the letter figured ouer them. Your eye must euer be placed in the end of the longer staffe c. and with the other eye ye ought to winke.

What these words meane Longitude, Latitude, Altitude.

These trifles and such like omitted, letteth the truth to come to passe, and make men to suspect the Ground, which is most certaine.

How heights standing directly vp, are measured by the Instrument.

The iij, Chapter.

PVt the staffe g. vpon the longer c. f. and moue him his iust length from the beginning of the longer c. turne the ends of g. toward you, and according to that height placing your eye (as is sayd) euer at the beginning of the longer c. with the other eye winke. Then goe backe vntill ye may plainely perceiue the very vpper part of that Altitude, and also the lower end by the extreames of your shorter staffe g. Now the space of the middle of your sight to the base of the height is equall with the Altitude.

Or thus.

When ye shall see any Altitude, whose measure ye require, imagine by coniecture how oftentimes that height is found in the space from it vnto your standing. Then moue your shorter staffe (chosen as aboue most conuenient) euen as often his owne length from the beginning of the longer c.

where your eye is euer placed. This done, turne the ends of your little ſtaffe, your eye being in e. according to the height: loke whether ye may ſée by the extremes of your ſhorter the very top, and alſo the loweſt part of the height. If not, moue the ſhorter a length further toward f. or nérer to e. as ye ſée cauſe, and as your coniecture failed. Or let your little ſtaffe remaine, as by coniecture hee was put, and goe forward or from that height, vntill the Altitude agrée iuſtly with the extremes of your ſhort ſtaffe. Then marke that place with the middeſt of your foote.

Now ye may conclude, that the height is as often contained in the diſtance, which is betwéene the marke and it, as the length of that little ſtaffe is found removed from the end of the longer, &c.

Example.

How the iuſt height is knowne.

If the ſhort ſtaffe be ten times his owne length from e. affirme the height contained in that diſtance ten times only.

The Altitude is thus gotten. Now your ſhort ſtaffe from his late being a length either toward or from e. as ye liſt to goe in or backe. Then goe fro or nére vnto it (as before) vntill the very ſummitie, and alſo the loweſt part of the height agrée with the extremes of your ſhorter ſtaffe. The ſpace then betwéene your marked place and this latter, declareth the iuſt height. Oftentimes through impediments, yée ſhall not haue rome to goe ſo farre backe or forward, as the height commeth vnto. This remedie is prouided.

A remedy prouided for want of ground.

Now the little ſtaffe haſte his length, and ſo ſéeke two ſtations (as before) vntill the extreme of the ſhorter ſtaffe be found iuſtly to anſwere either end of the height. Then the ſpace betwéene the two ſtandings muſt be doubled to haue the iuſt height: or if ye liſt, ye may moue the ſhorter, according to the fourth part of his length, or to any portion, as to the liſt, firt, twenty, &c. then ſhall ye haue that part of the height betwéene the two ſtations.

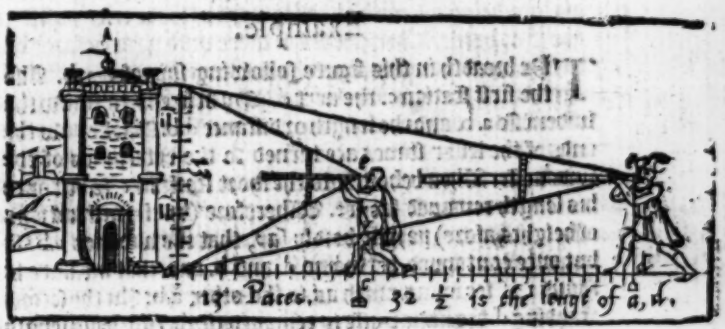
Yet

Yet know this (which experience by diligent practise will shew) the bigger parts ye take, the lesser sure ye commit. A little error often multiplied, encreaseth to a great.

Now that all the aforespoken may the better be perceiued, behold the example ensuing, as ye may see by figure declared, in the which the height is imagined a.b. the first station c. the short staffe g. is moued from c. iust his length. I am forced to conclude, that the Base of the height a b. is from my standing c. euen his proiectile length. So then if ye measure that distance of a.c. being 13. paces, ye haue the true height of a.b. as many. In the other standing place d. the shorter staffe is found from c. twise his length and a halfe, wherefore I must affirme the height a.b. to be contained or found in the distance a.d. twise and a halfe: which length a.d. is apparant 32. paces. All this that is spoken of the height, may well be vnderstood of Latitudes or wideneſſes, and lengths following.

The ground of this may be gathered of Euclide in his perſpectiue. 21. Theo.

In Altitudes this rule is not perfect, except the eye be leuell with the middle of the Altitude.



How the breadth or widenes of things are found, and by them, Length or any distance at pleasure.

The iiij. Chapter.

WHatsoeuer I haue instructed afore of heights, the same vnderstand here of widenes, lengths, &c. For none other wise are Latitudes or widenesses searched by this instrument, then before is declared of heights, onely this excepted, that the short staffe must lie contrary, the ends according to the breadth, seeing by the extreames of the short staffe, the very vttermost parts or ends of the Latitude, noting your stations right with the midst of your sote. And so performe all as afore. And as I said, thereof the parts of the height found betweene your standings, euen the same things is well vsed here, for all maner parts of the breadth.

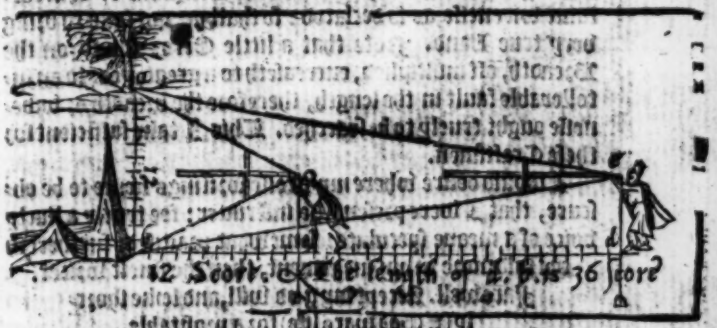
Example.

THe breadth in this figure following supposed a. b. And the first station c. the nert d. My desire is to know the widenesse a. b. and the length or distance d. b. Marke how the ends of the lesser staues are turned to the extreames of the widenesse. Then behold how the short staffe in c. is but once his length remoued from c. Wherefore (by the instructions of heights afore) ye may boldly say, that the widenes a. b. is but onte contayned betweene d. and b. and that measure is found 12. score, as much as is the other a. b. In the second standing d. the little staffe is remoued three times his length from c. For that cause I conclude (and truly) from b. to that station three times the breadth, which breadth is 12. score. So by the widenes I haue found the length of b. d. 36. score, my desire. Thus are Latitudes found, and by them Lengths, &c.

Behold

Behold the figure.

Ye muſt alway ſtand directly againſt the middle of the Breadth.



Whenſoeuer any diſtance is put, whoſe certaine length yée require: meaſure (by the aforeſpecified) either the height of any thing there found, or the breadth, and ſée how often-times that wideneſſe or length is contained vnto your ſtanding, which knowne: the length cannot be hid, as is declared.

NOw in fewe wordes to conclude, yée may by this Inſtrument meaſure the diſtance of Houſes, Stéeples, Trées, the length of Walles, the breadth of Ditches, Images in height, and ſuch like. The good wittie Carpenter ſtanding in a place, where he may plainely ſée a whole houſe, or any maner frame with great pleaſure, may by this get ſpeedily the true proportion of that houſe, which he ought to note in a Table, and when time commeth (not without his great prayſe) may make, reare and ſet vp the like. This I take to be ſufficient for theſe Craftſmen. A more larger vſe of this Inſtrument.

I haue

How y length of land is exactly found.

I Haue before forgotten to admonish you whensoeuer ye list to measure any Land exactly, by the instrument Geometricall, named the profitable Staffe, to set vpright a Rodde, the length of a Pearch. Or if the distance be long, to passe out, or rather subtly meate fiue or moe Pearches at the end or head of your length, the extreames noted with two visible marks. Then goe from thence, and seeke the Lengthes by that certaine wideneſſe, as is declared: so shall ye not faile to bring very true Land. Note that a little Error found on the Breadth, oft multiplied, encreaseth to a great, yea, to an intollerable fault in the length, therefore the breadth or wideneſſe ought truely to be searched. This I take sufficient for these Craftinesses.

I would desire where my grosse writings seeme to be obscure, that I were present the instructer: for truely a finely voice of a meane speculator somewhat practised, further eth ten fold more in my iudgement, then the finest writer.

Farewell. Accept my good will, and take shortly (if God spare life) for a profitable encreaſe of these matters.

FINIS.